

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave Blank)		2. REPORT DATE 14 Jul 97		3. REPORT TYPE AND DATES COVERED Interim 14 May 97 - 14 Jul 97	
4. TITLE AND SUBTITLE Optimization of Properties of a New Material for Electronic and Magnetic Applications				5. FUNDING NUMBERS Contract N00014-97-C-0209	
6. AUTHOR(S) Dr. Jack Olsen Dr. Steven Kim					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SKION Corporation 50 Harrison Street Hoboken, NJ 07030				8. PERFORMING ORGANIZATION REPORT NUMBER  SKI 0001	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) DCMC Springfield Bldg 1 ARDEC Picatinny, NJ 07086-5000				10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p style="text-align: center;">DISTRIBUTION STATEMENT A</p> <p style="text-align: center;">Approved for public release; Distribution Unlimited</p> </div>				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  <p>The molecular beam epitaxy (MBE) system is being prepared for the preparation of manganese arsenide/gallium arsenide (MnAs/GaAs) composite films. The chamber has been evaluated for quality of the vacuum: A pressure in the <math>10^{-8}</math> Torr range was obtained within hours without bakeout. The bakeable all metal valve connected to the turbo pump was found to leak through the valve seating when the valve was closed. Repairs are being made on the chamber and on the Boostovac ion pump controller.</p> <p>Drawings have been prepared for the effusion cells in the molecular beam source. Professor Tamargo has agreed to provide access to her commercial MBE system to produce large are MnAs/GaAs samples. The effusion cells are available for deposition and it will be possible to exactly reproduce the deposition conditions of Rothberg and Harbison's work that was cited in the SBIR proposal. SKION will utilize AES, RHEED and LEED to provide in situ analysis to establish optimal growth parameters.</p>					
14. SUBJECT TERMS molecular beam epitaxy gallium arsenide manganese arsenide in situ analysis				15. NUMBER OF PAGES 3	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT unclassified	20. LIMITATION OF ABSTRACT		

NSN 7540-01-280-5500  
WWW/AMBI/REF

DTIC QUALITY INSPECTED 8

REF D

Standard Form 298 (Rev. 2-89)  
Prescribed by ANSI Std. Z39-18  
298-102

**Progress Report**

Item No: 0001AA

**Title of the Project:**

Optimization of Properties of a New Material for Electronic and  
Magnetic Applications

<b>Topic No.:</b>	BMDO 97-014
<b>Contract No.:</b>	BMDO N00014-97-C-0209
<b>Contract Starting Date:</b>	May 14, 1997
<b>Contract Ending Date:</b>	December 14, 1997
<b>Contractor:</b>	SKION Corporation 50 Harrison Street Hoboken, NJ 07030

**Prepared By:**

Drs. J. Olsen & S. Kim  
Principal Investigator  
SKION Corporation

**Report Date: July 14, 1997**

DTIC QUALITY INSPECTED 3

19970717 187

Following the proposed statement of work, we have spent the first month of our contract preparing the MBE system for deposition.

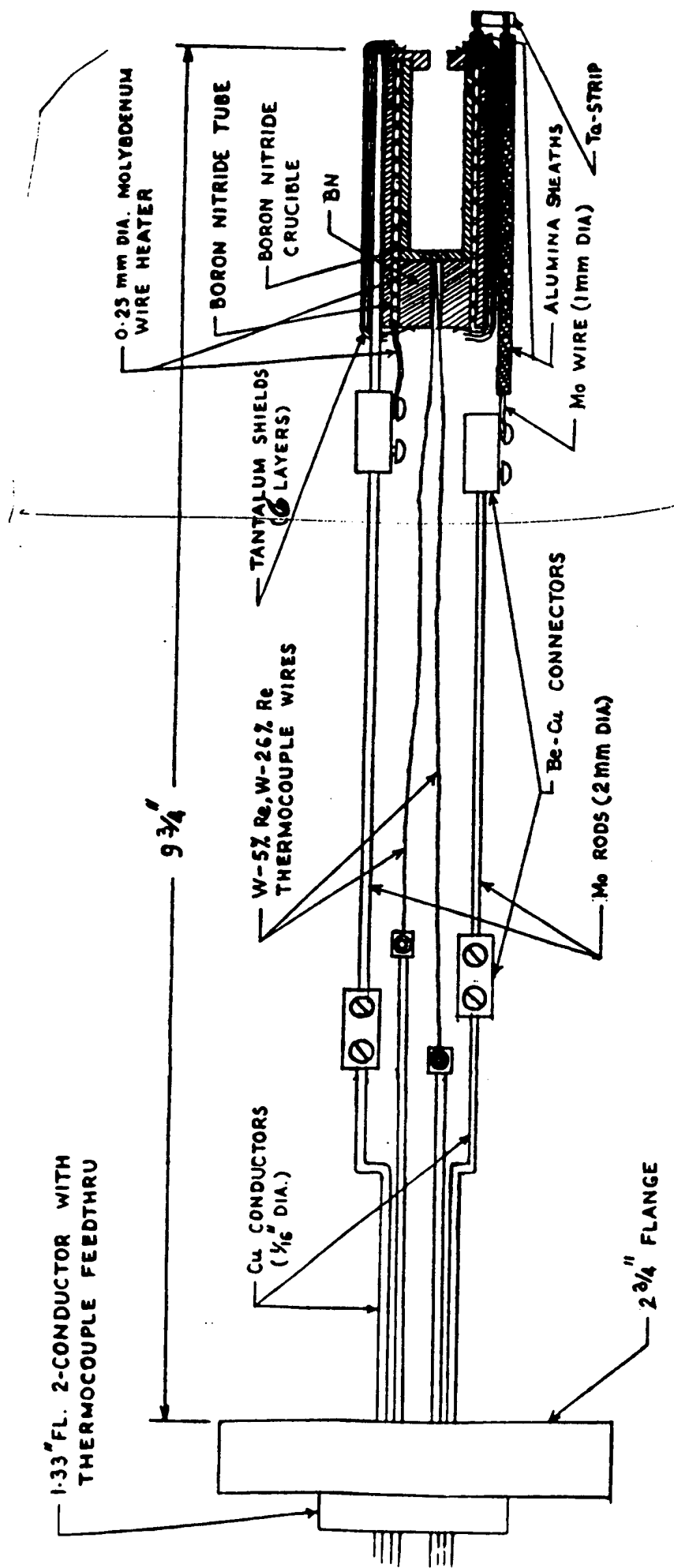
***The Summary of the activities performed in the period from May 14 to July 14, 1997:***

1. The molecular beam epitaxy (MBE) system at Stevens is being put in order for the preparation of manganese arsenide/gallium arsenide (MnAs/GaAs) composite films. The Stevens MBE system is a custom built, bakable ultrahigh vacuum R&D tool, equipped with a bakable Pfeiffer-Balzers turbo pump, a bank of Perkin Elmer ion pumps, and a titanium sublimation pump. The chamber is fitted for Auger electron spectrometry (AES), reflection high energy electron diffraction (RHEED), and low energy electron diffraction (LEED). The chamber has been evaluated for quality of the vacuum: A pressure in the  $10^{-8}$  Torr range was obtained within hours without bakeout. The bakeable all metal valve connected to the turbo pump was found to leak through the valve seating when the valve was closed—A replacement sealing pad and bonnet seals have been ordered. Repairs are also being made to a Boostivac ion pump controller. The system is fundamentally sound and ready for the installation of the effusion cells.
2. Drawings have been prepared for the effusion cells in the molecular beam source. Parts and materials suppliers have been investigated in terms of price and delivery time considerations. Parts and materials are being ordered.
3. Orders have been placed for various tools, parts, and supplies to be used in this project.
4. On April 30, Dr. Rothberg filed a patent application related to the effects of electric fields on these materials.
5. Professor Maria Tamargo at the City College of New York has agreed to provide access to her commercial MBE system to produce large area MnAs/GaAs samples. Professor Rothberg had collaborated with the previous owner of this MBE system (Bellcore) to carry out the pioneering work for this project. The effusion cells from the previous work are still in the machine and are available for deposition. This is an exciting development since it will be possible to reproduce exactly the deposition conditions of Prof. Rothberg's work with Bellcore that was cited in the SBIR proposal and in the patent application which was previously mentioned. By using this familiar MBE system, several weeks will be save in sample preparation. It will be possible, then, for SKION to take a more analytical approach with the Stevens MBE

growth and analysis system, utilizing its capabilities for Auger electron spectroscopy, x-ray photoelectron spectroscopy, and low energy electron diffraction to establish optimal growth parameters as well as x-ray diffraction and magnetooptic Kerr effect.

6. An abstract entitled "Electric Field Effects on Magnetic and Optical Properties of MnAs/GaAs (001) Thin Films" was submitted to the Seventh Joint Magnetism and Magnetic Materials - Intermag Conference to be held in San Francisco in January. The work forming the background for the present project will be reported.

# MOLECULAR BEAM SOURCE



GERALD ROTHBERG  
 STEVENS INSTITUTE OF TECHNOLOGY  
 6/2/97